

A NEW *RHADINOCERAEA* (HYMENOPTERA: TENTHREDINIDAE) FEEDING ON *ZIGADENUS* (LILIACEAE) FROM SOUTHEASTERN UNITED STATES¹

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ABSTRACT: *Rhadinoceraea (Veratra) zigadenusae*, n. sp., is described from the southeastern United States. Young larvae feed on the developing stamens and pistils and older larvae consume open flowers of *Zigadenus densus* and *Z. leimanthoides*. The species is described and illustrated and notes on its life history are given. Plants of the tribe Veratrae (Liliaceae) possess alkaloids toxic to many animals, and species of *Rhadinoceraea (Veratra)* are among the few herbivores of this tribe.

Sawfly larvae feeding on flowers of *Zigadenus densus* (Descr.) Fernald and *Z. leimanthoides* A. Gray were discovered by the junior author during studies on the relationship between plant fecundity and herbivores. Examination of the adults associated with these larvae revealed a new species of sawfly of the genus *Rhadinoceraea*. This new species resembles the only other eastern North American species of the genus, *Rhadinoceraea nubilipennis* (Norton).

Eight North American species of *Rhadinoceraea* were treated by Smith (1969), four in the typical subgenus and four in the subgenus *Veratra*. All occur west of the Rockies except for *R. nubilipennis*. Known hosts are *Calochortus* sp. for *R. (R.) nigra* (Rohwer) and *Veratrum* spp. for *R. (V.) aldrichi* (MacGillivray), *R. (V.) insularis* (Kincaid), and *R. (V.) nubilipennis*. *Zigadenus* represents a new host plant for sawflies. All hosts are in the family Liliaceae.

Rhadinoceraea (Veratra) zigadenusae Smith, new species

Figs. 2, 4, 6, 8, 10

Female. — Length, 7.0–8.0 mm. Black, only outer surfaces of forefemur and foretibia brownish. Wings uniformly, darkly, black infuscated; veins and stigma black. Third antennal segment slightly longer than 4th. Tarsal claw simple. Sheath as in Figs. 2, 4; 3rd valvula (sheath) only slightly longer than 2nd valvifer (basal plate). Lancet as in Figs. 2, 6, with about 10 serrulae, each serrula with 2 or 3 anterior and 5 or 6 posterior subbasal teeth.

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Male. — Length, 5.5-6.5 mm. Coloration as for female. Third antennal segment subequal in length to 4th. Genitalia as in Fig. 8.

Larva. — Very similar to that described for *R. nubilipennis* by Smith (1969), differing only by the shape of the body tubercles. The body tubercles are lower and more rounded (Fig. 10) than the higher and more conical tubercles of *R. nubilipennis* (Fig. 9).

Holotype. — ♀. "Mississippi, Jackson Co., ca. 11 mi. N. Pascagoula, on Big Point Road, 2 mi. E Hwy 63, 21 April 1987, Will McDearman"; mesic pine savanna, adult collected on *Zigadenus densus*. Deposited in the National Museum of Natural History, Washington, D.C. by permission of W. McDearman.

Paratypes. — MISSISSIPPI: Same data as for holotype (6 ♀, 6 ♂); Pearl River Co., Crosby Arboretum, Dead Tiger Creek Savanna, ca. 2.5 mi. E Picayune, 2 mi. S Hwy 43, 28 April 1987. Will McDearman, mesic pine savanna and pitcher plant bog, adults collected on *Zigadenus densus* (1 ♀, 5 ♂); Hancock Co., Crosby Arboretum, Hillside Bog, ca. 3.5 mi. E Picayune, 0.5 mi S Hwy 43, 28 April 1987. Will McDearman, hillside pitcher plant bog, adults collected on *Zigadenus densus* (1 ♀, 1 ♂). Deposited in the following collections; Mississippi Museum of Natural Science, Jackson; Mississippi Entomological Museum, Mississippi State University, Mississippi State; National Museum of Natural History, Washington, D.C.; and Canadian National Collection, Ottawa.

Distribution. — In addition to the above Mississippi localities based on adults, larvae have been collected from the following localities by WMCD: ALABAMA: Mobile Co., ca. 1 mi. E Hwy 193 and 1 mi N Hwy 193-163 junction on Old Rangeline Rd., 14 May 1987, on *Z. densus* in recently burned mesic longleaf pine savanna. NORTH CAROLINA: Caldwell Co., Grandfather Mtn., ca. 1/2 mi. N Grandfather Mtn. Visitor Center, on trail between McRae Peak and Attic Window Peak, 5,800 ft. elev., 7 August 1986, on *Z. leimanthoides* in heath barren, host plant populations small and widely scattered, ca. 300 plants. SOUTH CAROLINA: Jasper Co., ca. 1/2 mi. W of Hwy 17 at Switzerland, 17 May 1987, on *Z. densus* in recently burned longleaf pine savanna. WEST VIRGINIA: Tucker Co., Monongahela National Forest, Dolly Sods, ca. 1 mi. W Red Creek Campground, 3500 Ft. elev. 9 August 1986, on *Zigadenus leimanthoides* in heath barren and bog, extensive host plant population of over 2,000 plants.

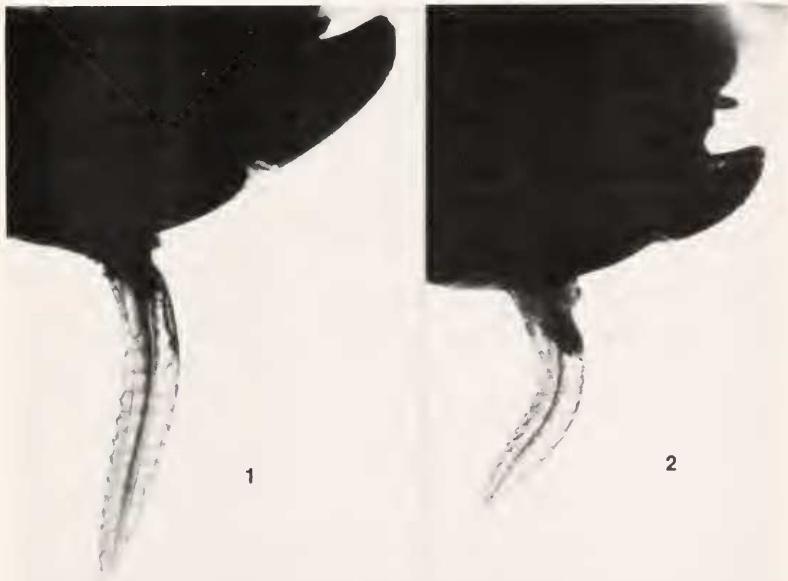
Remarks. — This species runs to *R. nubilipennis* in Smith's (1969) key to North American *Rhadinoceraea*. In general habitus, color, and size it is similar to that species, but close examination reveals differences in the female sheath and ovipositor and the male genitalia. The female sheath is much smaller than that of *R. nubilipennis* (Figs. 1-4, photographs and drawings to same scale from similar sized individuals). This is difficult to compare without having representatives of both species, but valvula 3 (sheath) of *R. nubilipennis* is about 1.4 times the length of valvifer 2 (basal plate). Valvula 3 of *R. zigadenusae* is only slightly longer than the length of valvifer 2. The ovipositor of *R. zigadenusae* is much shorter than that of *R. nubilipennis*, the former having about 10 serrulae, the latter about 14 (Figs. 1, 2, 5, 6, photographs and drawings to same scale from similar sized individuals). The serrulae of each species are very similar. The male is somewhat more difficult to differentiate, and the only differences noted are in the genitalia. The harpe of *R. zigadenusae* has a more distinct indentation on its inner margin, the apex of the parapenis is somewhat flatter, and the penis valve is somewhat broader apically than in *R.*

nubilipennis (compare Figs. 7, 8).

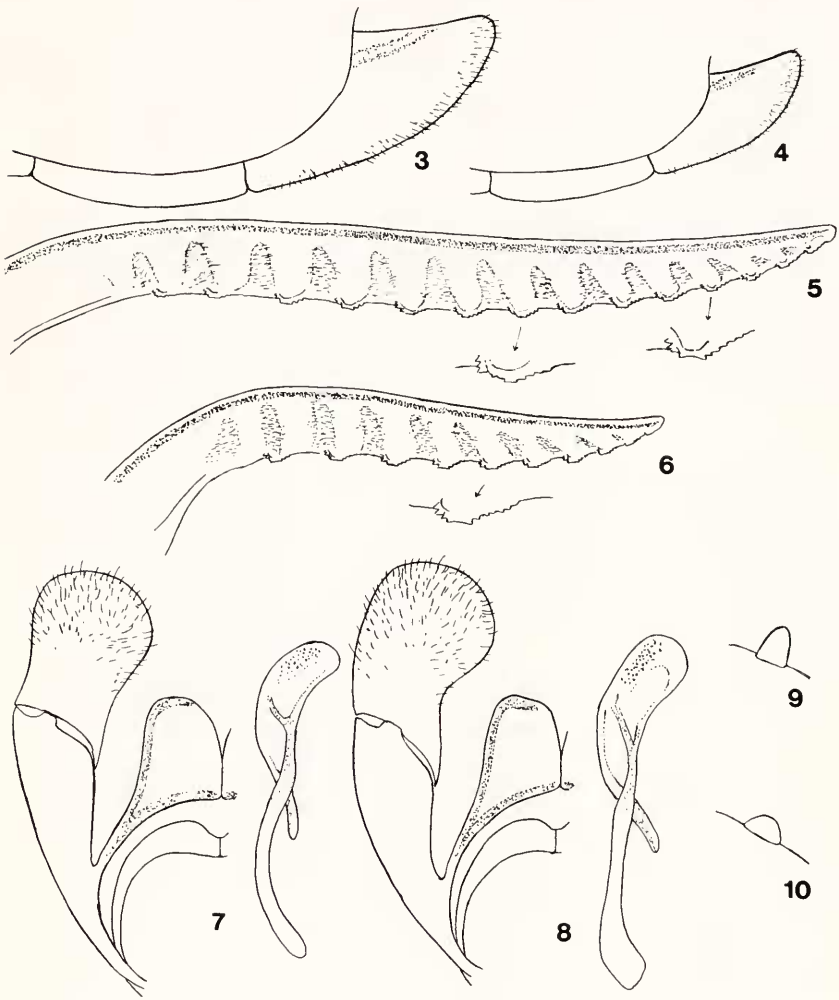
The specific name is based on the host plant genus.

Hosts and biological notes

Rhadinoceraea nubilipennis occurs only in the northeastern U.S. and southeastern Canada, south in the Appalachians to North Carolina. Its host, *Veratrum viride* Ait. is a northern plant and is found mostly at higher elevations further south. *Zigadenus densus* and *Z. leimanthoides* occur in bogs, flatwoods and mesic savanna primarily on the lower coastal plain from Louisiana east through Florida, and from southern peninsular Florida north through New Jersey. Disjunct populations are isolated in central Tennessee and the mountains of North Carolina and West Virginia. The junior author has collected larvae of *R. zigadenusae* on the coastal plain from Mississippi to South Carolina and from the disjunct host populations in North Carolina and West Virginia. Host populations in the Appalachian basin of Florida and surrounding vicinity



Figs. 1, 2. Apex of abdomen, sheath, and exerted saw of female. 1. *Rhadinoceraea nubilipennis*. 2. *R. zigadenusae*. Photographs of same magnification.



Figs. 3, 4, Female sheaths. 5, 6, Female ovipositors. 7, 8, Male genitalia. 9, 10, Body tubercles of larvae. 3, 5, 7, 9, *Rhadinoceraea nubilipennis*. 4, 6, 8, 10, *R. zigadenusae*.

were surveyed for two years without producing any evidence of sawflies. Peninsular Florida populations and those from North Carolina north to Delaware were not surveyed. Adult sawflies were collected only in Mississippi.

Nothing is known about the life history of *R. nubilipennis* except for its host. However, a related species, *R. aldrichi* (MacGillivray) in western North America, oviposits in and feeds on the foliage of *Veratrum* spp. This is very different from the habits of *R. zigadenusae* which oviposits in the inflorescence stalk and feeds on the developing stamens and pistils or open flowers of *Zigdenus*.

In southern Mississippi, *R. zigadenusae* emerged and flew in the spring, usually from late April to early May, which coincided with the period when the host plant was just beginning to flower. Females oviposited a single egg by inserting the ovipositor into subdermal and cortical plant tissues on the primary inflorescence stalk. Of 20 ovipositing females observed, all deposited one egg per plant visit and then flew to another plant. The position and number of eggs was identifiable by a nodule of swollen plant tissue. In Mississippi, 14 eggs was the maximum number observed on a single plant. Larvae hatched within 5 to 10 days and emerged by boring a small exit hole in the stalk. Young larvae typically moved up the inflorescence and entered a flower bud where they fed on the developing stamens and pistils. Older larvae consumed open flowers, and secondarily fed on fruits. When all flowers were consumed, larvae ate the dermal tissue of the inflorescence stalk before dispersing. In plant populations where the period of ovipositing and hatching occurred before the inflorescence was fully developed, larvae consumed unopened flowers as well as most of the inflorescence stem. As a last resort, larvae would attempt to feed on basal leaves, but less than 1% of all observed infested plants displayed leaf damage and less than 5% of the leaf area was damaged. When mature, in mid to late May on the coastal plain, larvae burrowed shallowly into soil to pupate. Only one generation was produced each year.

Although larvae did not defoliate host plants or cause plant mortality, floral herbivory caused a direct reduction in plant fecundity. Sawfly larvae were observed in 12 of 17 host plant populations in southern Mississippi and literally all flowers were consumed in the majority of these host populations. *Zigadenus densus* and *Z. leimanthoides* often occur in the same habitat on the coastal plain with the sympatric *Z. glaberrimus* Michx. However, sawflies did not utilize *Z. glaberrimus* as a host. The flowering interval between the host species and *Z. glaberrimus* is about three months.

Rhadinoceraea zigadenusae cannot be described as a monophagous floral herbivore since two host species are known, but the taxonomic dis-

inction between *Zigadenus densus* and *Z. leimanthoides* has recently been questioned (McDearman, 1984). The nature of character differentiation among these two species as well as whether *Z. leimanthoides* should be reduced to an infraspecific taxon or treated as a synonym is the subject of ongoing research. Nevertheless, the ecological specialization of *R. zigadenusae* is much more restricted than the current host plant nomenclature may suggest.

The alkaloids of the plant tribe Veratrae, which includes *Zigadenus*, *Veratrum*, and four other genera, are the subject of an extensive literature (e.g., Kupchan *et al.*, 1961; Tomko and Voticky, 1973). These compounds, commonly known as the "veratrum" alkaloids, can physiologically act as neurotoxins (Narahashi, 1975; Jones *et al.*, 1970), as teratogens (Van Kampen *et al.*, 1969; Keeler, 1971), and as vaso-dilators (Anon, 1975; Page and Sidd, 1973). Crosby (1971) has reviewed the extremely poisonous group of ester-alkaloids, their toxicity to a wide variety of insects, and the history of their agricultural applications.

Considering the ecological implications of veratrum alkaloid research as well as the role of defensive alkaloids in other plants (Levin, 1976; Miller and Feeny, 1983; Zuniga *et al.*, 1985) it is remarkable that only a few of the 64 species of the Veratrae have been reported as hosts to herbivorous insects. Moreover, the known herbivores in North America consist of four species of *Rhadinoceraea*. The Veratrae-*Rhadinoceraea* (*Veratra*) association suggests that the distinctive alkaloid phytochemistry may be involved with sawfly speciation in *Rhadinoceraea*. Future studies are planned by the junior author to address fundamental questions regarding host plant phytochemistry.

ACKNOWLEDGMENTS

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SOCIETY MEETING OF NOVEMBER 29, 1989

(Continued from page 12)

Kenneth Frank, M.D. commented on the dramatic increase in *Ixodes dammini*, the tick vector of Lyme disease. Nymphs of this species were uninvited guests at the AES Insect Field Day in the New Jersey Pine Barrens last June. A number of participants were unknowing hosts, although none developed the annular rash associated with Lyme disease. Dr. Frank cautioned that entomologists, who are frequently in the field, are more likely to contract the disease than the general public and should be aware of the prevention, recognition and treatment of the disease. He distributed copies of a recent review on Lyme disease that appeared in the August 31 issue of the *New England Journal of Medicine*.

Paula Haines described her observations on strepsipterans she had found parasitizing *Polistes* wasps. Her request for more information was answered by Dr. Paul Schaeffer who had worked with *Xenos peckii* in the past.

Mr. and Mrs. Chaiken, operators of the gift shop at the Academy of Natural Sciences, displayed a number of insect-related books and gifts with insect motifs. Also available for examination and purchase were beautifully mounted specimens of the large and showy insects of the world.

Harold B. White,
Corresponding Secretary